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<p>(21) International Application Number: PCT/FI98/00104</p> <p>(22) International Filing Date: 4 February 1998 (04.02.98)</p> <p>(30) Priority Data: 970538 7 February 1997 (07.02.97) FI</p> <p>(71)(72) Applicant and Inventor: VANHALA, Markku [FI/FI]; Kauppakatu 7 B 4, FIN-48100 Kotka (FI).</p> <p>(74) Agent: KOLSTER OY AB; Iso Roorinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
<p>(54) Title: CLEANING DEVICE FOR FILTER OF DUST FILTER DEVICE</p> <p>(57) Abstract</p> <p>The invention relates to a cleaning device for a filter of a dust filter device, the cleaning device comprising a frame element (5) that is arranged outside the filter (1) to move in relation to the filter and is provided with opening elements (6) and nozzles (7), the opening elements (6) being arranged to open gaps between lamellas of the filter (1) in response to a movement of the frame element (5), and the nozzles (7) being arranged to direct an air jet parallel to the normal air flow between the lamellas opened by the opening elements (6) and to remove the dust from between the lamellas. To provide a sturdy and efficient structure, the air for the nozzles of the frame element (5) is arranged to be fed through a feed pipe (8) arranged at the symmetry axis of the filter (1).</p>			

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CLEANING DEVICE FOR FILTER OF DUST FILTER DEVICE

The invention relates to a cleaning device for a filter of a dust filter device, the cleaning device comprising means for feeding air through the filter to a direction opposite to the normal air flow direction, and a frame element 5 that is arranged outside the filter to move in relation to the filter and is provided with opening elements and nozzles, the opening elements being arranged to open the gaps between the lamellas of the filter in response to a movement of the frame element, and the nozzles being arranged to direct an air jet parallel to the normal air flow between the lamellas opened by the opening elements 10 and to remove dust from between the lamellas.

Different cleaning devices and methods are well known particularly in connection with different dust filter devices. Apparatuses in which dust filter devices are used include, for example, different aspirators, particularly industrial aspirators, ventilation systems, etc.

15 Previously known in the field are, for example, systems in which an air flow that cleans the filter is generated by the motor of an aspirator. Examples for such systems include, for example, the solutions presented in German Patents 595,686 and 666,446.

A drawback of the above solutions is that they are inefficient and 20 complicated. In some applications, the filter element also has to be detached and then attached to the blow side of the aspirator. A problem here is that the action is laborious to carry out and that impurities spread to the environment.

Another previously known basic solution is to detach the filter to be cleaned from the aspirator and to clean it, for example, by compressed air. A 25 drawback of the solution is that it is laborious to perform and that impurities spread to the environment. The cleaning result is also fully dependent on how careful the person doing the cleaning is.

To eliminate the above drawbacks, a solution has been developed in which a compressed-air device is placed inside the aspirator and arranged 30 to direct a compressed-air jet to the filter in a direction opposite to the normal air flow direction in a desired manner so as to clean every part of the filter. A solution like this is known from Finnish Patent 78,388.

In most conditions the above solution is quite satisfactory, but in 35 some situations problems arise. Problems arise, for example, when the filter is overloaded or the dust consists of fibrous particles.

When the filter is overloaded, the dust packs tightly between the lamellas of the filter, pressing them tightly against one another. The gaps on the inner surface of the filter close, and so the pressure impact from inside the filter cannot penetrate between the lamellas of the filter and the dust cannot be 5 detached.

When the dust is light and porous, it remains between the lamellas in the suction step, forming a continuous felt-like mat. During the cleaning, a pressure impact penetrates between the lamellas, cleaning their upper ends. The dust then wedges between the lamellas and air flows out through the 10 porous dust; the fibrous material, however, does not become detached.

To eliminate the above drawbacks, a solution has been developed in which the dust wedged between the lamellas of the filter is removed by opening the gaps between the lamellas and directing an air jet parallel to the normal air flow between the lamellas. This basic principle is known from 15 Finnish Patent Application 961,873. With the basic principle known from the above patent application the filter can be cleaned fairly efficiently. A problem with the solution is, however, that it is cumbersome to carry out, and so the application of the principle has not been fully successful in every respect.

The object of the invention is to provide a cleaning device by which 20 the drawbacks of the prior art can be eliminated. This is achieved with a cleaning device according to the invention, the device being characterized in that the air for the means and nozzles of the frame element is arranged to be fed through a feed pipe arranged at the symmetry axis of the filter.

The major advantage of the invention is its efficiency: the filter can 25 be cleaned efficiently and quickly under all conditions. The structure described in the invention is sturdy, small and reliable, and it allows a rotational movement of the frame element without any complicated mechanisms. A further advantage of the invention is its simplicity, on account of which the introduction and use of the invention are cost-effective. Another feature 30 contributing to the cost-effectiveness of the introduction to use is that the invention can also be applied in connection with aspirators currently used. The filters can be cleaned mechanically without rotating them, so the filters can be sealed better than before and the risk of dust leak diminishes. Due to the power transmission solution a rotation motor can be placed outside the filter 35 unit in a clean space. This eliminates the risk of dust explosion caused, for example, by the sparking of an electric motor, and facilitates potential

servicing of the motor. Due to the invention compressed air can be distributed both to the frame element and to compressed-air guns in a particularly advantageous manner, so that the inconvenient reciprocating movement can be eliminated. The distribution of air further enables the simultaneous use of a
5 compressed-air gun and mechanical agitation, which reduces the time spent for cleaning the filters.

In the following the invention will be described in greater detail with reference to a preferred embodiment illustrated in the attached drawing, in which

- 10 Figure 1 shows a general view of a cleaning device of the prior art,
Figure 2 shows a general view illustrating a basic principle of
cleaning a filter developed in connection with the solution illustrated in Figure
1,
Figure 3 shows a detail of Figure 2 in the direction of arrow A,
15 Figure 4 shows a general side view of a cleaning device according
to the invention.
Figure 5 shows an enlarged view of a structural detail of Figure 4,
Figure 6 shows a detail of a cleaning device illustrated in Figures 4
and 5, and
20 Figure 7 shows a cleaning device according to the invention in
connection with an industrial aspirator.
Figure 1 shows a general view of a previously known cleaning
device for a filter of a dust filter device. The figure shows a filter 1 and means
2, for example, for feeding air of a compressed-air gun through the filter 1 in a
25 direction opposite to the normal air flow direction. The means 2 comprise, for
example, a nozzle element 3 and a compressed-air container 4. The nozzle
element 3 is arranged to direct an impact of compressed air to the inner
surface of the filter 1 in the desired manner, as shown by arrows N in Figure 1.
The normal air flow direction is indicated by arrows M in Figure 1. The nozzle
30 element 3 is rotated by the impact of the air flow. The structure shown in
Figure 1 can be found, for example, in an industrial aspirator, a welding gas
aspirator, or in some other such apparatus or system.
A person skilled in the art will regard the solution of Figure 1 as
conventional technology, so the operation and structure of the solution are not
35 discussed in greater detail herein. Reference is here made to the above-

mentioned Finnish Patent 78,388 which describes the principle of the solution illustrated in Figure 1.

Figures 2 and 3 show a general view illustrating a basic principle of cleaning a filter developed in connection with the device illustrated in Figure 1.

- 5 In Figures 2 and 3, like reference numbers indicate correspondingly as in Figure 1. Figure 3 shows an enlarged view of a detail of Figure 2 in the direction of arrow A.

According to the principle illustrated in Figures 2 and 3, the cleaning device comprises a frame element 5 arranged outside the filter 1 to move in 10 relation to the filter. The frame element 5 is provided with opening elements 6 and nozzles 7. The opening elements 6 are arranged to be in contact with the outer surface of the filter 1 and to open the gaps between lamellas 1a of the filter 1 in response to a movement of the frame element 5. The nozzles 7 are also arranged to direct an air jet parallel to the normal air flow M between the 15 lamellas 1a opened by the opening elements 6 and to remove the dust from between the lamellas 1a.

The above basic principle is described in detail in Finnish Patent Application 961,873, so the details will not be described here more closely.

A drawback of the basic principle illustrated in Figures 2 and 3 is 20 that the frame element 5 can only rotate 180° to and fro, as the means for feeding air prevent a continuous rotating movement in one direction only. Difficulties in supporting the frame element have been an additional drawback: it has been difficult to provide a structure sturdy enough.

Figures 4 to 7 show a cleaning device according to the invention 25 applying the basic principle known from Finnish Patent Application 961,873. However, the above basic principle is implemented in the invention so, that the above drawbacks are eliminated. In Figures 4 to 7, like reference numbers indicate correspondingly as in Figures 1 to 3.

The basic idea of the invention is to provide a structure that makes 30 the implementation of the basic principle known from Finnish Patent Application 961,873 possible. An essential idea of the invention is that air for the means 2 and the nozzles of the frame element 5 is arranged to be fed through a feed pipe 8 arranged at the symmetry axis of the filter 1. In the example illustrated by the figures, air is arranged to be fed into the feed pipe 8 35 through a support 9 serving as a support member of the feed pipe. In the example illustrated by the figures, the feed pipe 8 comprises an element of

telescopic pipes 8a, 8b that is arranged to serve also as a lifting device for the filters 1.

- The lower part of the frame element 5 is mounted on the feed pipe 8 by means of a bearing element 10, and the upper part on a tooth-wheel rim 12 by means of a sliding fit allowing a vertical movement, the tooth-wheel rim being arranged to transmit the rotational movement to the frame element 5. The bearing element 10 is also arranged to distribute air to the means 2 and the nozzles 7 of the frame element 5. The rotational movement of the frame element is made possible by a power source 13, for example an electric motor.
- 10 The operation of the cleaning device of the invention can be described briefly in the following manner. The cleaning is based on the idea that counterparts, for example the opening elements 6 trailing on the surface of the filter 1, agitate a filter pleat. In addition to the agitation of the filter pleat, cleaning of the filters is enhanced by compressed air fed into the filter pleat.
- 15 The details are known from Finnish Patent Application 961,873 as stated above. In the example illustrated in Figures 3 to 7 the rotation motor 13 placed outside the jacket 14 of the filter unit rotates the tooth-wheel rim 12 placed inside the filter unit. Vertical pipes 5a, 5b of the frame element 5 are attached to the tooth-wheel rim 12. The vertical pipes 5a, 5b are attached to the tooth-wheel rim 12 by means of a sliding fit allowing a vertical movement, for example by a slide tube 15. By means of the above sliding fit, for example, an irregular movement of the tooth-wheel rim can be compensated. The opening elements 6 serving as cleaning trails are attached to the vertical pipes 5a, 5b. So when the tooth-wheel rim 12 rotates, the frame element 5 rotates, and the opening elements 6 circle the filters 1 and clean them in the above described manner. To the lower parts of vertical pipes 5a, 5b are additionally attached cleaning elements 16, for example cleaning cams, by means of which material fallen off the filters 1 onto the conical part of the jacket 14 is scraped and dropped into a collecting receptacle 17.
- 20 30 Beneath the filter unit, at the symmetry axis of the filter unit and parallel to it, there is the air feed pipe 8 of the filter serving simultaneously as an air distributor, a bearing and a filter lifting device. The feed pipe 8 comprises telescopic parts 8a, 8b that are adjustable in relation to each other by means of an adjusting element 18. The adjusting element 18 can be, for example a screw element. By means of the adjusting element the filters can be lifted and thus compressed against the jacket.
- 25 35

Air is fed into the feed pipe 8, for example through a solenoid valve 19 and a support 9. So the air flows into the feed pipe and further to the bearing element 10 that distributes the air flow to the means 2, for example to a compressed-air gun, and the vertical pipes 5a, 5b of the frame element. The 5 air is directed to the means 2 with an angular part 20 and pipe elements 21, 22. The pipe elements 21 and 22 are detachable and attachable with one another by means of connecting sleeves 23, 24, so that a pipe element and a sleeve form a unit of the height of the filter. By means of a piping solution like this the filters 1 with the compressed-air guns can be installed and removed 10 one at a time.

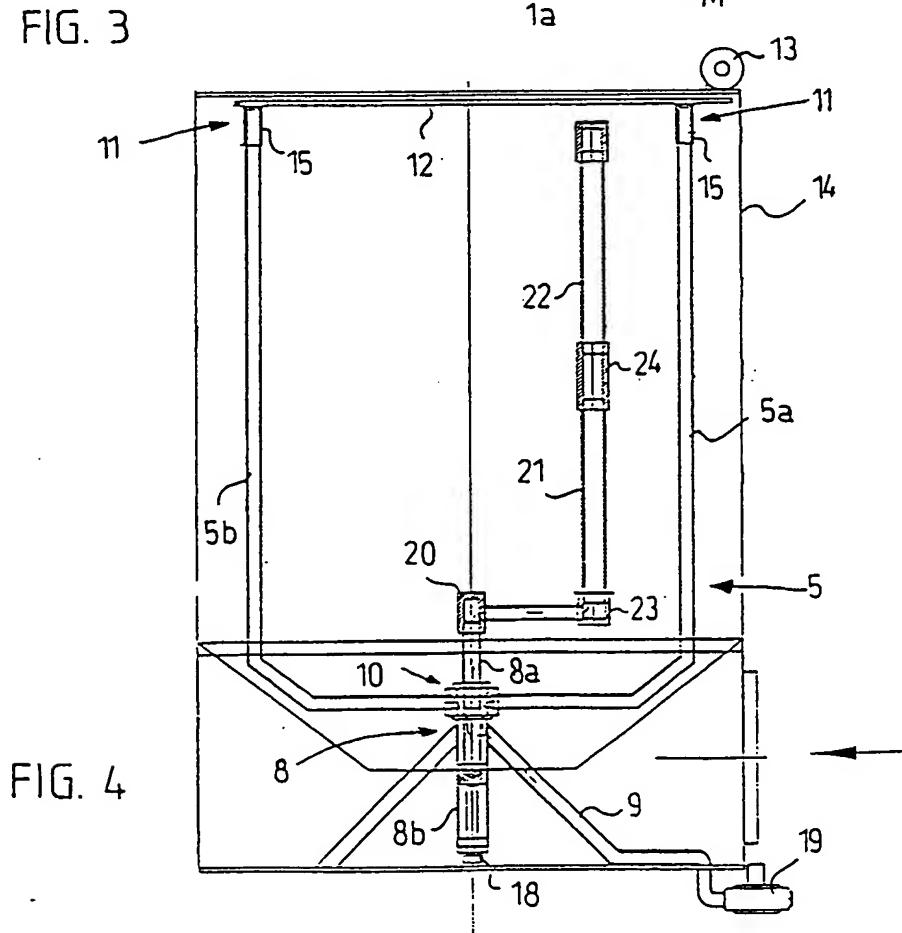
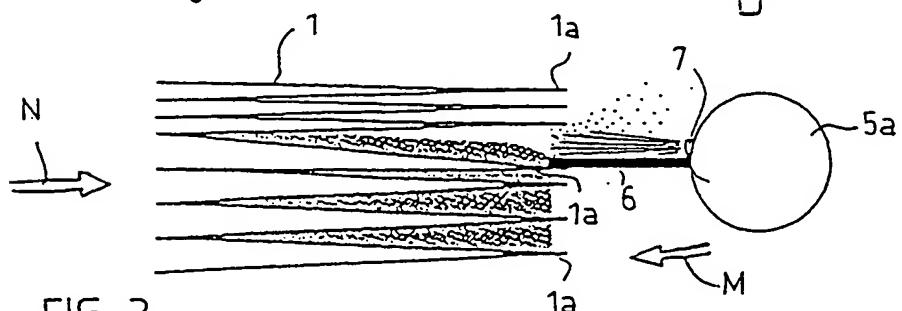
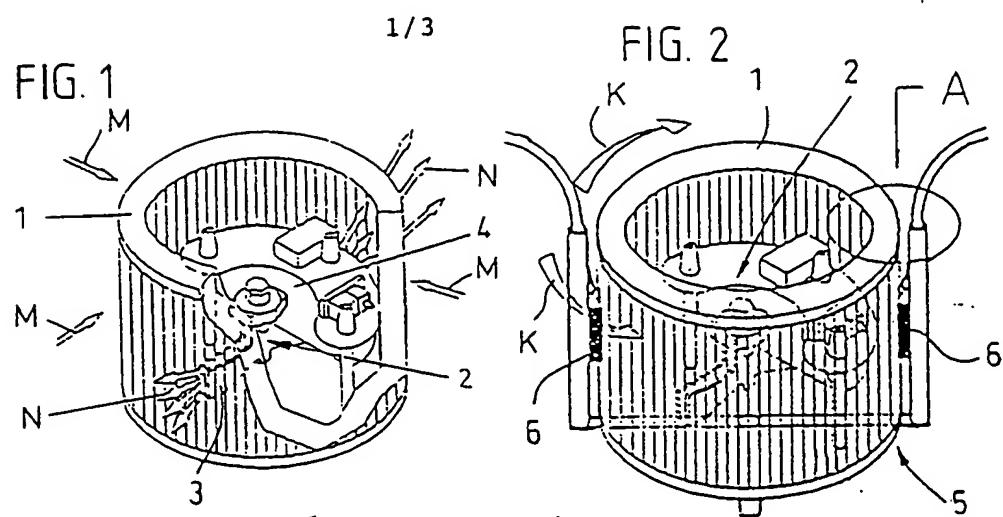
During the cleaning process air is fed into the feed pipe 8 and distributed in two directions as explained above. A major part of the compressed air is conveyed through the pipe elements 21, 22 to the compressed-air guns. A minor part of the compressed air is conveyed through 15 the bearing element 10 to the vertical pipes 5a, 5b of the frame element 5 from which it is fed through the nozzles 7 into the filter pleats according to the basic principle illustrated in figure 3. The nozzles 7 can be, for example apertures of the size of about 1mm provided in the vertical pipes 5a, 5b.

The above embodiment is not intended to restrict the invention in 20 any way, but the invention can be modified quite freely within the scope of the claims. It is thus to be understood that a cleaning device of the invention or any details thereof need not necessarily be exactly as shown in the figures, but that other kinds of solutions are also possible. For example, the filter may comprise one or more filter elements, for instance two filter elements as 25 illustrated in Figure 7, etc.

CLAIMS

1. A cleaning device for a filter of a dust filter device, the cleaning device comprising means (2) for feeding air through the filter (1) to a direction (N) opposite to the normal air flow direction (M) and a frame element (5) that is arranged outside the filter (1) to move in relation to the filter and is provided with opening elements (6) and nozzles (7), the opening elements (6) being arranged to open gaps between lamellas (1a) of the filter (1) in response to a movement of the frame element (5), and the nozzles (7) being arranged to direct an air jet parallel to the normal air flow (M) between the lamellas (1a) opened by the opening elements (6) and to remove the dust from between the lamellas (1a), **characterized** in that air for the means (2) and the nozzles (7) of the frame element (5) is arranged to be fed through a feed pipe (8) arranged at the symmetry axis of the filter (1).
2. A cleaning device as claimed in claim 1, **characterized** in that air is arranged to be fed into the feed pipe (8) through a support (9) serving as a support member of the feed pipe.
3. A cleaning device as claimed in claim 1 or 2, **characterized** in that the feed pipe (8) comprises an element of telescopic pipes (8a, 8b) that is arranged to serve also as a lifting device for the filters (1).
4. A cleaning device as claimed in any one of claims 1 to 3, **characterized** in that the frame element (5) is mounted in its lower part on the feed pipe (8) by means of a bearing and in its upper part on a tooth-wheel rim (12) by means of a sliding fit (11) allowing a vertical movement, the tooth-wheel rim being arranged to transmit the rotational movement to the frame element (5).
5. A cleaning device as claimed in claim 4, **characterized** in that the upper part of the frame element (5) is mounted on the tooth-wheel rim (12) by means of a slide tube.
6. A cleaning device as claimed in claim 4 or 5, **characterized** in that the rotational movement of the tooth-wheel rim (12) is arranged to be transmitted by means of a power source (13) arranged outside the tooth-wheel rim.
7. A cleaning device as claimed in any one of claims 1 to 6, **characterized** in that a bearing element (10) arranged in the lower part of the frame element (5) is arranged to distribute air to the means (2) and the nozzles (7) of the frame element (5)

8. A cleaning device as claimed in any one of claims 1 to 8,
c h a r a c t e r i z e d in that cleaning elements (16) that come in contact with
a conical part beneath the filter (1) are arranged in the lower part of the frame
element (1).



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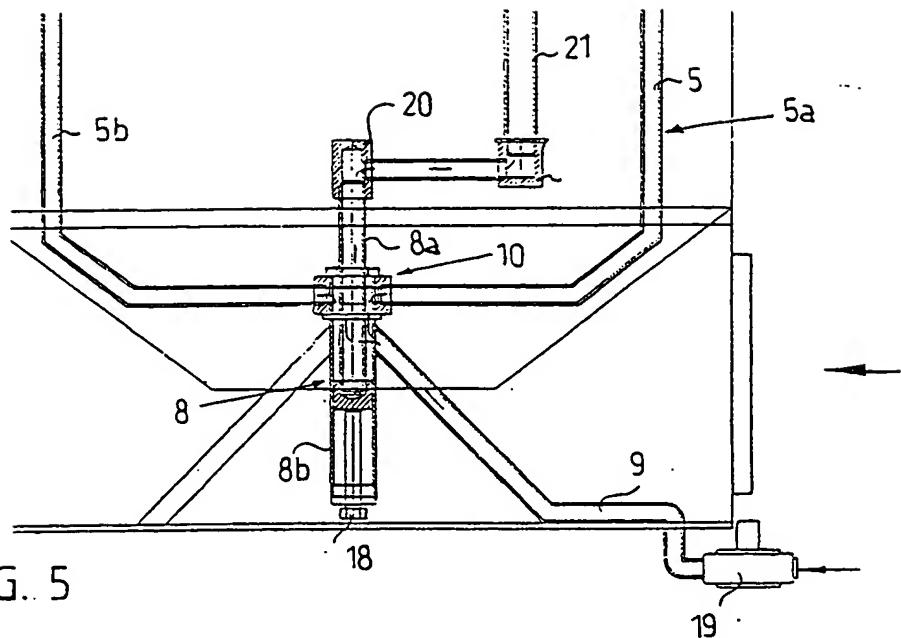


FIG. 5

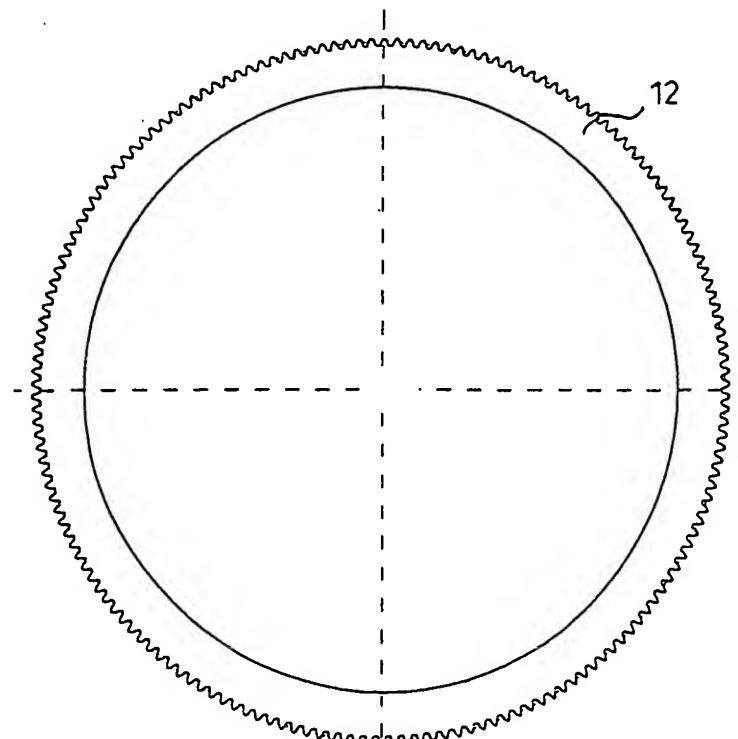


FIG. 6

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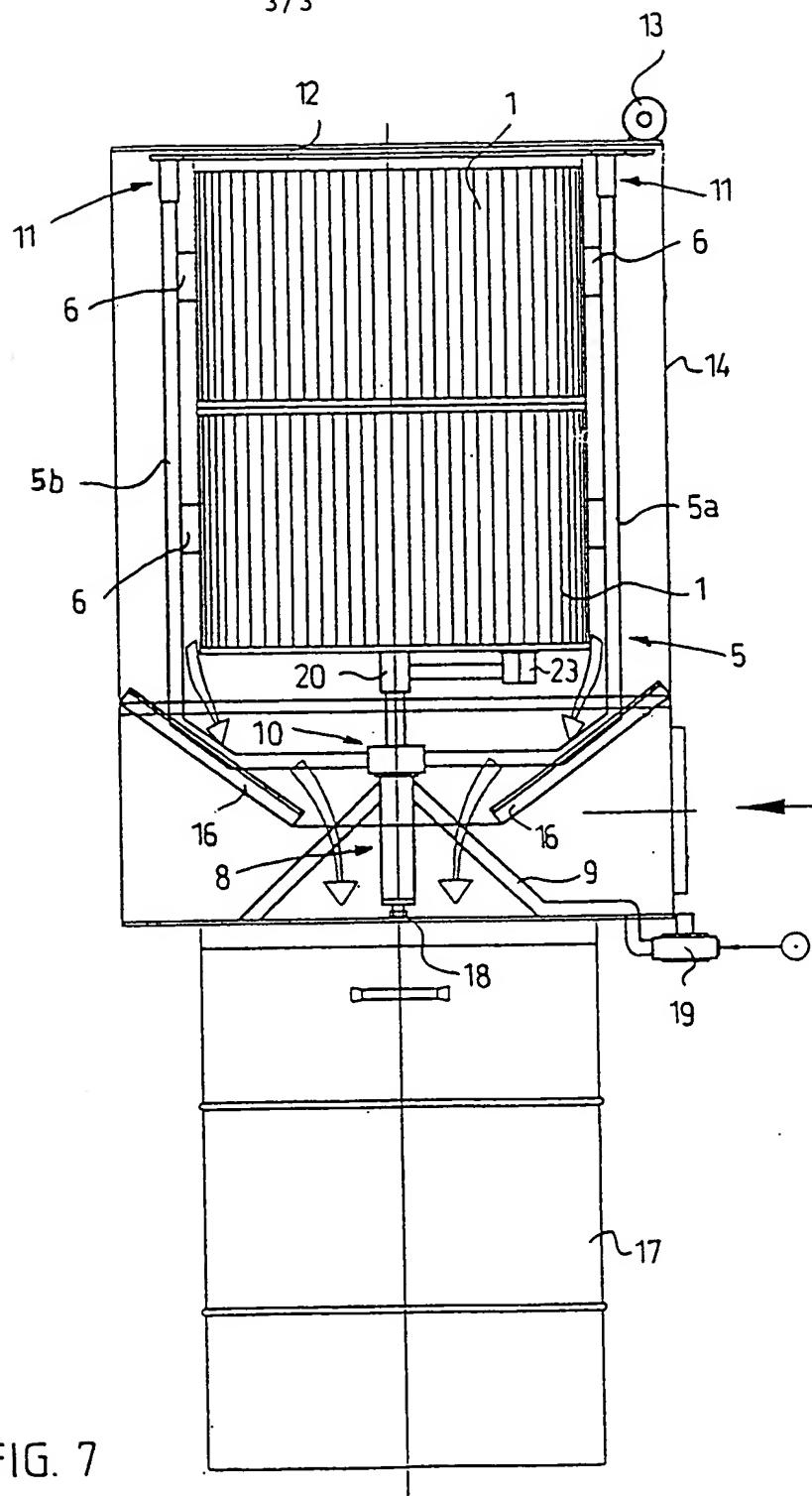


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00104

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B01D 46/52, B01D 29/62

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC6: B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 9741945 A1 (VANHALA, MARKKU), 13 November 1997 (13.11.97), figures 2,3, abstract --	1-8
A	US 4661129 A (BILL P.P. NEDERMAN), 28 April 1987 (28.04.87), column 2, line 54 - column 3, line 18, figure 3 -- -----	

 Further documents are listed in the continuation of Box C. See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

29/04/98

International application No.	
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9741945 A1	13/11/97	AU 2639597 A FI 100641 B FI 961873 A		26/11/97 00/00/00 03/11/97
US 4661129 A	28/04/87	CA 1268430 A DE 3584046 A EP 0169330 A,B SE 0169330 T3 JP 1640509 C JP 3001047 B JP 60261522 A SE 451947 B,C SE 8402918 A		01/05/90 17/10/91 29/01/86 18/02/92 09/01/91 24/12/85 09/11/87 01/12/85